

EX. Amdt
12/03

Listing of the Claims:

For the Examiner's convenience, the following listing of claims sets forth all claims currently pending in the application. No amendments are made to the claims in this paper.

1. (Previously Presented) A substrate processing chamber comprising:
a chamber body;
a chamber top disposed on the chamber body; and
a transformer-coupled plasma generator plate within the substrate processing chamber having a plurality of transformer cores within the transformer-coupled plasma generator plate and a plurality of through holes forming conduits from a first side of the transformer-coupled plasma generator plate to a second side of the transformer-coupled plasma generator plate, a first of the conduits passing through a first transformer core and a second of the conduits not passing through a transformer core.

2. (Canceled).

²
~~3.~~ (Original) The substrate processing chamber of claim 1 wherein the plasma generator plate is flat.

³
~~4.~~ (Previously Presented) The substrate processing chamber of claim 1 wherein a first primary coil is disposed to electro-magnetically couple to the first transformer core and a second primary coil is disposed to electro-magnetically couple to a second transformer core within the transformer-coupled plasma generator plate, wherein the first primary coil and the second primary coil are connected to each other in series.

⁴
~~5.~~ (Previously Presented) The substrate processing chamber of claim 1 wherein the transformer core comprises ferrite material.

⁵
~~6.~~ (Original) The substrate processing chamber of claim 1 wherein the transformer-coupled plasma generator plate includes a dielectric spacer between the first side and the second side, and a remainder of an outer surface of the generator plate comprises an electrical conductor.

⁶
~~7.~~ (Original) The substrate processing chamber of claim ⁵~~6~~ wherein the dielectric spacer is disposed within a conduit through the transformer-coupled generator plate.

⁷
~~8.~~ (Original) The substrate processing chamber of claim 1 further comprising an alternating-current power supply configured to operate at a frequency of about 1 KHz-2 MHz.

⁸
~~9.~~ (Original) A substrate processing chamber comprising:
a chamber body;
a chamber top disposed on the chamber body;
an alternating-current power supply; and
a transformer-coupled plasma generator plate having a plurality of through holes forming conduits from a first side of the transformer-coupled plasma generator plate within the substrate processing chamber to a second side of the transformer-coupled plasma generator plate within the substrate processing chamber, a first portion of the conduits passing through centers of a plurality of toroidal transformer cores within the generator plate and a second portion of the conduits not passing through centers of transformer cores, the generator having a first surface comprising metal, a second surface comprising metal, and a plurality of dielectric spacers disposed between the first surface and the second surface in each of the first portion of the conduits.

⁹
~~10.~~ (Previously Presented) A plasma generator plate ^{within a substrate processing chamber} comprising:
a first side;
a second side;
a first conduit passing from the first side to the second side through a first transformer core within the plasma generator plate;

a second conduit passing from the first side to the second side through a second transformer core; and

a third conduit passing from the first side to the second side not passing through a transformer core.

10
11. (Original) The plasma generator plate of claim 10 further comprising a first dielectric spacer in a first secondary current path around the first transformer core.

12. - 17. (Canceled).

~~18. (Withdrawn)~~ ^{*cancelled*} A plasma processing system comprising:
a first substrate support structure configured to hold a first substrate in a processing chamber;
a second substrate support structure configured to hold a second substrate in the processing chamber; and
a transformer-coupled plasma generator within the processing chamber disposed between the first substrate support structure and the second substrate support structure.

~~19. (Withdrawn)~~ ^{*cancelled*} The plasma processing system of claim 18 wherein the transformer-coupled plasma generator includes a toroidal transformer core.

~~20. (Withdrawn)~~ ^{*cancelled*} The plasma processing system of claim 18 wherein the plasma generator comprises a plasma generating plate having a plurality of transformer cores within the plasma generating plate and a plurality of through holes forming conduits from a first side of the plate to a second side of the plate.

21. (Canceled).

~~22. (Withdrawn)~~ ^{*cancelled*} A plasma generator comprising:
an inlet in fluid communication with;

a first conduit passing through
a first toroidal transformer core and through
a second toroidal transformer core;
a second conduit completing a plasma current circuit, in cooperation with the first
conduit, around the first toroidal transformer core and around the second toroidal transformer
core; and
an outlet in fluid communication with the first conduit.

conceded
23. (~~Withdrawn~~) A plasma generator comprising:
an inlet in fluid communication with
a first conduit passing through a first transformer core and with
a second conduit passing through a second transformer core;
a third conduit in fluid communication with the first conduit to complete a first
plasma current circuit around the first transformer and in fluid communication with the second
conduit to complete a second plasma current circuit around the second transformer; and
an outlet in fluid communication with at least the first conduit and the second
conduit.

conceded
24. (~~Withdrawn~~) A substrate processing system comprising:
a process chamber with a chamber inlet;
a chamber exhaust; and
a transformer-coupled plasma generator having a first core,
a first conduit passing through the first core,
a second core,
a second conduit passing through the second core, and
a third conduit in fluid communication with the first conduit and the
second conduit to complete a plasma current circuit path through the process chamber.

conceded
25. (~~Withdrawn~~) The substrate processing system of claim 24 wherein the third
conduit is a center conduit completing a first plasma current circuit path around the first core

through the process chamber and the first conduit and completing a second plasma current circuit path around the second core through the process chamber and the second conduit.

cancelled
26. (Withdrawn) The substrate processing system of claim 24 wherein the first conduit and the second conduit comprise metal and further comprising a dielectric spacer in the plasma current circuit path.

cancelled
27. (Withdrawn) The substrate processing system of claim 24 further comprising:

a fourth conduit passing through
a third core; and
a fifth conduit passing through
a fourth core.

cancelled
28. (Withdrawn) The substrate processing system of claim 24 further comprising:
a first primary coil disposed to couple electro-magnetic energy to the first core;
a second primary coil disposed to couple electro-magnetic energy to the second core;
a third primary coil disposed to couple electro-magnetic energy to the third core;
a fourth primary coil disposed to couple electro-magnetic energy to the fourth core, wherein the first primary coil, the second primary coil, the third primary coil, and the fourth primary coil are coupled to an AC power supply.

cancelled
29. (Withdrawn) The substrate processing system of claim 28 wherein the first primary coil, the second primary coil, the third primary coil, and the fourth primary coil are connected in series with the AC power supply.

cancelled
30. ~~(Withdrawn)~~ The substrate processing system of claim 28 wherein the first primary coil, the second primary coil, the third primary coil, and the fourth primary coil are connected in parallel to the AC power supply.

cancelled
31. ~~(Withdrawn)~~ A plasma generator comprising:
an inlet configured to receive a plasma precursor, the inlet in fluid communication with a first plasma current path and with a second plasma current path;
a first conduit passing through
a first transformer core;
a second conduit passing through
a second transformer core, wherein the first conduit is essentially co-linear with the second conduit.

cancelled
32. ~~(Withdrawn)~~ A plasma generator comprising:
an outer shell surrounding a first inner shell housing a first toroidal transformer core; and
a second inner shell housing a second toroidal transformer core, wherein the first toroidal transformer core and the second toroidal transformer core are disposed along a common center axis.

cancelled
33. ~~(Withdrawn)~~ The plasma generator of claim 32 wherein the first inner shell is supported within the outer shell by a web allowing circulation of secondary plasma current around the first inner shell within the outer shell.

cancelled
34. ~~(Withdrawn)~~ The plasma generator of claim 33 wherein the web contains an electrical lead connected to a primary coil disposed to couple electro-magnetic energy to the first toroidal transformer core.

cancelled
35. ~~(Withdrawn)~~ The plasma generator of claim 32 wherein the first inner shell includes a shaped bottom portion to provide a circular cross-section to the inner shell.

36. canceled
36. ~~(Withdrawn)~~ The plasma generator of claim 32 further comprising:
an inlet; and
an outlet, both the inlet and the outlet lying along the common center axis.

37. canceled
37. ~~(Withdrawn)~~ An ion implantation system comprising:
an ion source having a toroidal plasma generator, and
an ion source aperture aligned essentially along a center line of the toroidal
plasma generator.

38. canceled
38. ~~(Withdrawn)~~ The ion implantation system of claim 37 further comprising a
first extraction electrode disposed to accelerate ions from the ion source toward a second
extraction electrode.

39. canceled
39. ~~(Withdrawn)~~ The ion implantation system of claim 37 wherein the toroidal
plasma generator includes a first core and a second core, the first core and the second core being
aligned essentially along a center line of the toroidal plasma generator.

40. (Canceled).

41. canceled
41. ~~(Withdrawn)~~ A plasma torch head comprising:
an outer nozzle;
an inner nozzle, the inner nozzle including a conduit passing through the inner
nozzle from an inlet side toward an outlet,
a toroidal transformer core surrounding the conduit; and
a bypass providing a return path for a secondary plasma current circuit around the
toroidal transformer core.

~~42. (Withdrawn)~~ *cancelled* The plasma torch head of claim 41 wherein the inner nozzle comprises metal and further including a dielectric spacer in the inner nozzle to prevent an electric path through the inner nozzle around the toroidal transformer core.

~~43. (Withdrawn)~~ *cancelled* The plasma torch head of claim 41 wherein a first gas is flown through the conduit and a second gas if flown through the bypass, the first gas being different from the second gas.

~~44. (Withdrawn)~~ *cancelled* The plasma torch head of claim 43 wherein the first gas is oxygen and the second gas is either propane or hydrogen.

~~45. (Withdrawn)~~ *cancelled* The plasma torch head of claim 41 further comprising a primary coil disposed to couple electro-magnetic energy to the toroidal transformer core wherein the primary coil and the toroidal transformer core are enclosed within the inner nozzle.

46. - 48. (Canceled).

~~49. (Withdrawn)~~ *cancelled* An ion source for an ion milling apparatus, the ion source comprising:

a transformer-coupled toroidal plasma generator (having a primary coil disposed to couple electro-magnetic energy to a toroidal core, the transformer-coupled toroidal plasma generator disposed to provide plasma along a center line of the transformer-coupled toroidal plasma generator toward an accelerator plate.

~~50. (Withdrawn)~~ *cancelled* The ion source of claim 49 wherein the transformer-coupled toroidal plasma generator further includes a second toroidal core.

51. - 52. (Canceled).